

Sport Fish Harvest from Rough River, Kentucky, Before and After Impoundment

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Abstract

Creel surveys were conducted on Rough River, Kentucky, for 1 year (1959) before impoundment and for the first 4 years (1961-64) after impoundment to measure changes in fishing effort, angling success, creel composition, and total harvest. Fishing effort increased considerably after impoundment, from a mean of 28 man-hours per day for 214 days of fishing on the river to a mean of 1,058 man-hours per day for 765 days of fishing on the reservoir. Fishing intensity increased from 57 man-hours per hectare in 1959 to a mean of 123 man-hours per hectare during the first 3 complete years of fishing on the reservoir, 1962-64. Fisherman success was also greater in the new reservoir than it had been in the corresponding segment of the river, but decreased each successive year after impoundment. Fish were caught in Rough River Reservoir at the rate of 1.48 per man-hour in 1961, 0.99

in 1962, 0.96 in 1963, and 0.81 in 1964. Weight harvested per man-hour increased during the second year of impoundment as the condition of all sport fishes improved. In 1963, however, weight harvested per man-hour began to decline as the numbers of game fishes decreased and panfishes increased in the sport fishery.

The total sport-fish harvest from Rough River was estimated at 3,195 fish (410 kilograms) in 1959. The catch surged to 168,622 fish (13,437 kg) during the first survey year (consisting of a 4-month period) on the new reservoir, and during the next 3 survey years (consisting of 7 months each) an average of 216,944 fish (28,518 kg) was harvested.

The sport fishery in the headwaters to the reservoir was evaluated during the white bass spawning migration in 1963.

Introduction

The Kentucky Department of Fish and Wildlife Resources conducted creel surveys on Rough River for 1 year (1959) before impoundment, and on Rough River Reservoir during the first 4 years (1961-64) after impoundment. The sur-

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veys were designed to evaluate changes in the sport fishery (pole and line fishing) brought about by the transition from stream to reservoir and to provide information on the quality of fishing in the new impoundment.

Rough River, approximately 160 miles (258 km) long, is part of the Green River system of the lower Ohio River basin in western Kentucky (Figure 1, inset). In November 1955, the U.S. Army Corps of Engineers began construction of a flood-control dam at mile 89.3 (km 27.2) on Rough River; the project was completed in June 1961. Rough River Dam impounds about 5,100 surface acres (2,064 ha) of water at seasonal-pool level, elevation 151 m above mean sea level (msl). At this elevation the main stem of the reservoir is about 41 miles (66 km) long, and North Fork, the major tributary, is impounded for 25 miles (40 km). The reservoir is maintained at or near min-

imum-pool level (142 m above msl, surface area 688 ha) during the winter and at seasonal-pool level during the summer except when additional waters are stored for flood control. Seasonal-pool level is usually attained by April 1 and maintained until about September 1.

Rough River is best described as a dimictic reservoir, but thermal stratification is frequently disrupted by density currents, especially in the headwaters. The water is hard (total alkalinity averaged 130 ppm at the head of the reservoir in 1963-64) and pH generally ranges between 7 and 8. Estimates of fish biomass averaged 240 pounds per surface acre (270 kg per ha) during the first 4 years of impoundment.

The reservoir did not attain seasonal-pool capacity until March 1961, but waters were partially impounded during the winter of 1959-60. During this period, approximately 94,000 fish were introduced into the reservoir (Table

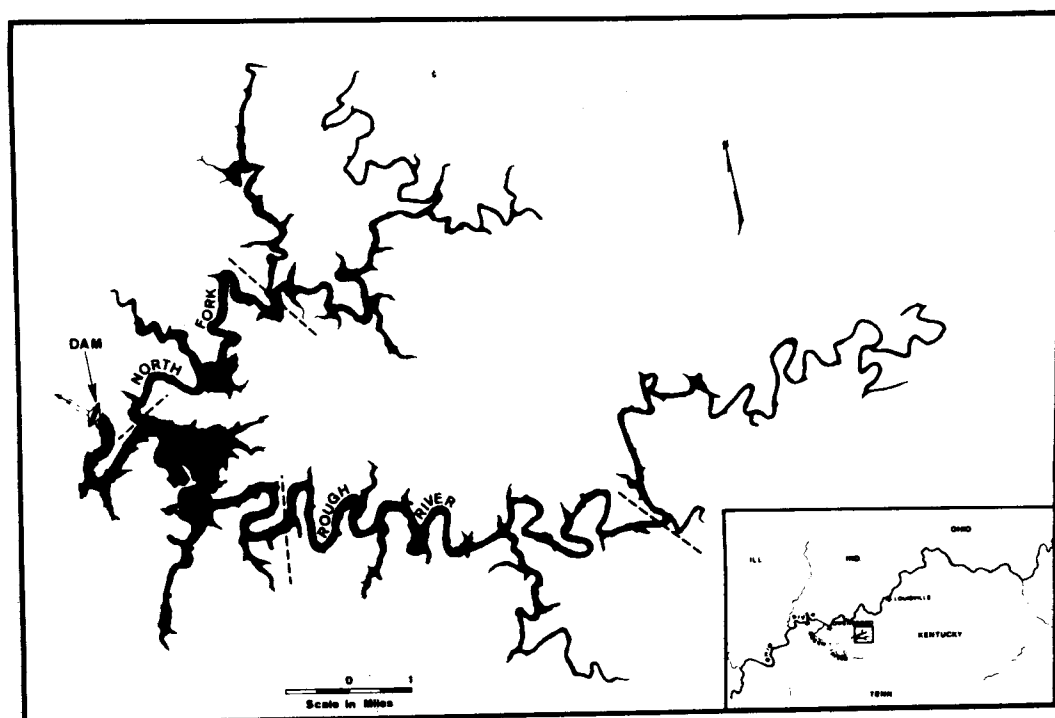


Figure 1. Rough River Reservoir. Broken lines designate sampling segments, two on the North Fork and three on the main stem. Inset shows the geographic location of the reservoir.

1)—an aggregate of largemouth bass, *Micropterus salmoides*, black crappie, *Pomoxis nigromaculatus*, bluegill, *Lepomis macrochirus*, and redear sunfish, *L. microlophus*. In April 1961, 289 white bass, *Morone chrysops*, in spawning condition were introduced. White bass, black crappie, and redear sunfish were not found previously during fish population studies in the river.

Rough River Reservoir was not opened to fishing until July 1, 1961 to allow both the native and introduced stock to spawn before being fished. A 12-inch (305 mm) minimum harvestable size for all black basses was established in the reservoir although there was no size restriction on bass before impoundment.

Survey Methods

Creel surveys were conducted by local conservation officers (creel clerks) who counted and interviewed fishermen according to a prearranged sampling schedule. The 214-day survey year began on April 1 and ended on October 31 and coincided with the period of greatest fishing activity on the reservoir. In 1961, the survey year included only 123 days because the reservoir was not opened to fishing until July 1.

A two-way stratified survey was used to estimate fishing effort on Rough River. The two-stemmed reservoir was divided into five segments, two on the North Fork and three on the main stem (Figure 1), and a different creel clerk

was assigned to each stem. The 12-hour fishing day, 7 a.m. to 7 p.m., was divided into four 3-hour periods for sampling on the North Fork and into three 4-hour periods for sampling on the main stem. On the two respective stems, each day of the week, each time period, and each reservoir segment was equally represented during the 214-day survey year. Each day of the week was completely sampled one time in each reservoir segment during the survey, and required representative sampling periods from 63 different days on the main stem and 56 different days on the North Fork.

Fishermen were counted and interviewed during each survey period. One-half of the counts preceded the fisherman interviews, and one-half followed the interviews but were completed by the end of the time period. Since the fisherman counts were obtained in less than 1 hour, the counts were considered as instantaneous. Fishing effort was estimated using the mean-count method outlined by Lambou (1961), namely, $F = Cx$;

where F = the estimated number of time units of fishing (man-hours), C = the total number of hours in the survey year, and x = the mean number of fishermen observed per count. Both bank and boat fishermen were included in the counts, but occupants of moving boats were not counted unless they were actually fishing.

The creel clerks interviewed as many fishermen as possible during the scheduled time period to obtain information

Table 1.—Fishes stocked in Rough River Reservoir during the early stages of impoundment

Species	Number	Total length (range in mm)	Month of introduction
Largemouth bass	9,400	150–230	October 1959
Largemouth bass	17,600	100–250	November 1959
Largemouth bass	26,600	75–80	July 1960
Black crappie	4,700	75–100	December 1959
Bluegill	1,000	75–100	March 1960
Bluegill	10,100	75–80	April 1960
Redear sunfish	25,000	25–50	April 1960
White bass	289	adult	April 1961

on the amount of time fished and the kinds, numbers, and lengths of fishes caught. Weights of fishes in the creel were estimated from average weights of those taken from the same waters during concurrent fish population studies. This information was used to determine rates of harvest and species composition of the creel. Total harvest was estimated by multiplying the rate of harvest by the total fishing effort.

Preimpoundment surveys in 1959 covered a total of 54 stream miles (87 km). Two creel clerks, one on North Fork and one on Rough River, counted and interviewed fishermen at public access points along the streams. The entire stream was surveyed during the designated time period on a given day. The preimpoundment estimates assumed that fishermen tended to congregate at the access points.

Fishing Effort and Intensity

Clearing operations in the Rough River watershed preparatory to impoundment almost completely discouraged fishermen from using the stream in 1960 and undoubtedly influenced fishing in 1959. Creel surveys

conducted in 1959, nevertheless, furnished the only measures of fishing effort and success on the stream before impoundment. Rough River supported an estimated 6,028 man-hours of fishing during a 214-day preimpoundment survey (Table 2). Although clearing in the river basin may have had an adverse effect on fishing, Rough River was not easily accessible and probably never attracted more than a small number of local fishermen.

Annual fishing effort on Rough River Reservoir during the first 4 years of impoundment was about 1,000 man-hours per day compared to 28 man-hours per day before impoundment. Fishing intensity more than doubled during the first 3 complete years of fishing on the reservoir; it increased from 23 man-hours per acre (57 man-hours per ha) in 1959 to 50 man-hours per acre (123 man-hours per ha) from 1962 through 1964.

The amount of fishing effort on Rough River Reservoir far exceeded that of other new flood-control reservoirs in Kentucky (Table 3). Expended effort was more than twice that on Barren Reservoir, more than 5 times that on Nolin Reservoir, and more than 20 times

Table 2.—Estimated fishing effort, fishing intensity, and fishing success on Rough River before and after impoundment

	Rough River	Rough River Reservoir			
	1959	1961	1962	1963	1964
Survey period (days)	214	123	214	214	214
Survey area (surface acres)	260	5,125	5,125	4,025	5,125
Survey area (hectares) ¹	105	2,074	2,074	1,629	2,074
Fishing effort:					
Total man-hours	6,028	113,934	256,582	209,504	241,598
Man-hours per day	28	926	1,199	979	1,129
Fishing intensity:					
Man-hours per acre	23	22	50	52	47
Man-hours per hectare	57	55	124	129	116
Fishing success:					
No. of fish per man-hour	0.53	1.48	0.99	0.96	0.81
Weight per man-hour (lb)	0.15	0.26	0.31	0.29	0.20
Weight per man-hour (kg)	0.07	0.12	0.14	0.13	0.09

¹ One hectare is equivalent to 10,000 square meters or 2.471 acres.

Table 3.—Fishing effort (man-hours per day) on four Kentucky flood-control reservoirs during the early years of impoundment

Reservoir	Year of impoundment				Mean
	1961	1962	1963	1964	
Rough River	926	1,199	979	1,129	1,058
Buckhorn ¹	27	63	61	—	50
Nolin ²	118	183	274	—	192
Barren ³	540	421	—	—	480

¹ Data from Turner (1967).

² Data from Carter (1968).

³ Data from Carter (1969).

that on Buckhorn Reservoir during the initial years of impoundment. The proximity of Rough River to population centers, such as Louisville and Owensboro, and the development of fishing facilities and accommodations accounted for the large amount of fishing pressure on the reservoir. Seven concrete launching ramps made all sections of the reservoir accessible to fishermen.

Fishing Success

Fishing success, measured as fish per man-hour, doubled from 0.53 before impoundment to a mean of 1.06 during the first 4 years of impoundment. The average weight harvested per man-hour during this same period increased from 0.15 to 0.27 pound (.07 to .12 kg). Fishing success was greatest (1.48 fish per man-hour) during the first year of impoundment, 1961, and decreased each year thereafter. By 1964, the rate of harvest had declined to 0.81 fish per man-hour. Although the average weights of most species increased steadily after impoundment (Table 4), the greater number of panfishes (*Lepomis* spp. and *Pomoxis* spp.) in the creel suppressed the weight harvested per man-hour.

Estimated Harvest and Creel Composition

Total sport-fish harvest was much greater after impoundment than before impoundment. The catch from Rough

Table 4.—Average weights of fishes harvested from Rough River before and after impoundment. Weights in pounds are subtended in parentheses by weights in kilograms

Species	Rough River		Rough River Reservoir		
	1959	1961	1962	1963	1964
Black basses	1.15 (0.52)	1.20 (0.54)	1.24 (0.56)	1.34 (0.61)	1.39 (0.63)
White bass	—	0.25 (0.11)	0.42 (0.19)	0.50 (0.23)	0.57 (0.26)
Crappies	—	0.41 (0.19)	0.44 (0.20)	0.32 (0.15)	0.32 (0.15)
Rock Bass	0.31 (0.14)	—	0.45 (0.20)	0.82 (0.37)	0.19 (0.09)
Lepomids	0.04 (0.02)	0.09 (0.04)	0.10 (0.05)	0.11 (0.05)	0.12 (0.05)
Catfishes	0.32 (0.15)	0.39 (0.18)	0.77 (0.35)	1.24 (0.56)	1.57 (0.71)
Suckers	1.47 (0.67)	—	0.96 (0.44)	1.12 (0.51)	1.86 (0.84)
Freshwater drum	—	—	—	1.42 (0.64)	—

River in 1959 was estimated at 3,195 fish weighing a total of 904 pounds (410 kg). After impoundment the catch was estimated at 168,622 fish, or 29,623 pounds (13,437 kg) in 1961; 254,015 fish, or 79,540 pounds (36,079 kg) in 1962; 201,123 fish, or 60,756 pounds (27,558 kg) in 1963; and 195,694 fish, or 48,320 pounds (21,917 kg) in 1964. Total harvest during the first year of impoundment was lower than during following years because of the shorter fishing season in 1961.

The average number of fish harvested per unit surface area increased from 12 per acre (30.4 per ha) before impoundment to 50 per acre (123 per ha) during the first 2 complete years of fishing on the new reservoir (Table 5). Similarly, the average weight harvested increased from 3.5 to about 15 pounds per acre (3.9 to 17.1 kg per ha) during these 2 peak fishing years.

Black basses. Largemouth bass (*Microp-*

terus salmoides) and spotted bass (*M. punctulatus*) were the chief species of black basses taken in Rough River before and after impoundment. A third species, smallmouth bass (*M. dolomieu*), was recorded in small numbers in the river system and probably contributed little to the catch. The native bass population was supplemented by stocking largemouth bass during the early stages of impoundment.

Black basses were a major component of the catch in the new reservoir and constituted as much as 44% of the total weight harvested in a single year. Their contribution to the total catch by weight averaged 37% during the first 3 years of impoundment, then dropped to 21% the fourth year.

White bass. In April 1961, 289 pre-spawning white bass (*Morone chrysops*) were introduced into Rough River Reservoir, and 11,129 were harvested during the 4-month survey period (July-

Table 5.—Estimated number and weight of fish harvested per hectare of surface water from Rough River before and after impoundment. Weight (kg) is shown in parentheses

Species	Rough River	Rough River Reservoir			
	1959	1961	1962	1963	1964
Black basses	1.4 (0.75)	3.7 (2.02)	13.7 (7.69)	10.3 (6.25)	3.6 (2.25)
White bass	— —	5.4 (0.60)	7.3 (1.40)	2.2 (0.50)	2.3 (0.60)
Crappies	— —	2.2 (0.41)	18.6 (3.68)	25.5 (3.72)	27.0 (3.91)
Rock bass	4.9 (0.69)	— —	0.3 (0.07)	<0.1 (0.01)	<0.1 (<0.01)
Lepomids	17.8 (0.36)	65.0 (2.56)	79.5 (3.48)	81.0 (3.95)	60.9 (3.42)
Catfishes	4.0 (0.59)	5.1 (0.89)	3.0 (1.07)	4.3 (2.41)	0.5 (0.34)
Suckers	2.3 (1.52)	— —	<0.1 (0.01)	<0.1 (0.02)	<0.1 (0.03)
Freshwater drum	— —	— —	— —	0.1 (0.06)	— —
Total	30.4 (3.91)	81.4 (6.48)	122.5 (17.40)	123.5 (16.92)	94.4 (10.55)

October) that year. More than 15,000 were harvested in 1962, but the catch decreased considerably during the 2 following years. The white bass supported an additional fishery in the headwaters during its spawning migration each spring.

Crappies. White crappies (*Pomoxis annularis*) were native to Rough River; 4,700 black crappie (*P. nigromaculatus*) were stocked in the partially impounded reservoir late in 1959. Although the species were not observed during creel surveys, over 90% of the crappies taken during fish population studies on the reservoir were white crappie and it was assumed that it was also the predominant species in the catch. Crappies first appeared in the creel during the first year of impoundment and the percentage composition, both by number and weight, increased each year afterwards. By 1962, the crappie yield was 38,483 individuals, ranking second only to lepidomids, and by 1964 the catch surged to 56,047 individuals. The estimated total weight of crappies (8,114 kg) harvested from the reservoir in 1964 was greater than that of any other species.

Rock bass. A relatively important sport fish in Rough River, second only to lepidomids in terms of numbers harvested, the rock bass (*Ambloplites rupestris*) diminished in importance immediately after impoundment. Rock bass did not appear in the creel during the first year of impoundment. In 1962, 711 were caught but less than 100 per year were taken during the two following fishing seasons. Primarily a stream fish, reduction in numbers of this species was attributed to habitat alteration.

Lepidomids. This term was used for convenience in categorizing all species of the genus *Lepomis*. Four species were native components of the Rough River fish fauna, and two of these, bluegill (*L. macrochirus*) and longear sunfish (*L. megalotis*), were the major constituents of the creel. Green sunfish (*L. cyanellus*) and the diminutive orangespotted sunfish (*L. humilis*) occurred in small numbers and contributed little to the catch.

After impoundment, the bluegill rapidly became established as the dominant lepidomid in the reservoir and was followed in order of decreasing abundance by longear sunfish, green sunfish, and redear sunfish (*L. microlophus*), an introduced species. Although no distinction among these species was attempted by the creel clerks, the catch composition probably paralleled their relative abundance. Numerically, lepidomids dominated the catch every year both before and after impoundment, and in 1961 constituted a greater percentage of the total weight than any group of fishes harvested.

Catfishes. Two species, the channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*), supported the catfish fishery in Rough River. After impoundment two previously unimportant species, yellow bullhead (*Ictalurus natalis*) and black bullhead (*I. melas*), increased rapidly in the catch during 1961 and 1962. The number of bullheads in the reservoir began decreasing in 1962 and none was recorded during the creel checks in 1964. Of the catfishes harvested in 1964, 87% was channel catfish and the remaining 13% was flathead catfish.

Catfishes contributed substantially to the sport-fish catch in Rough River Reservoir during the first 3 years of impoundment; the average yield during these 3 years was 7,941 catfish weighing 5,864 pounds (2,660 kg). In 1964 the catch declined to 998 catfish weighing a total of 1,570 pounds (712 kg).

Suckers. This group, comprising eight species of suckers and buffalo fishes, made up 39% of the total weight harvested from the river in 1959, but diminished in the sport-fish catch immediately after impoundment. Based upon relative abundance in population studies, spotted sucker (*Minytrema melanops*), black redhorse (*Moxostoma duquesnei*), and golden redhorse (*M. erythrurum*) dominated the catch.

Freshwater drum. Although recorded in fish population studies before and

after impoundment, the freshwater drum (*Aplodinotus grunniens*) was first detected in the creel during the third year of impoundment. Two hundred pounds (91 kg) were harvested in 1963, but the species failed to reappear in the catch in 1964.

Headwaters Survey

In March 1963, a special survey was conducted in the headwaters of Rough River Reservoir to evaluate the quality of fishing during the white bass spawning migration. Because of adverse weather, the spawning run was short-lived and lasted only 6 days. During this brief period, fishermen expended 1,408 man-hours on a 3-mile (4.8 km) stretch of Rough River and harvested 3,022 fish at the rate of 2.15 fish per hour. These fish weighed a total of 1,357 pounds (616 kg), or an average of 0.45 pound (0.20 kg) each.

A total of 1,339 white bass was harvested during the 6-day fishing period and accounted for 44.3 % of the number of fishes caught. White crappie was the second most numerous species in the creel (818) and was followed in order of decreasing abundance by suckers (448), leptomids (387), black basses (18), rock bass (6), and carp, *Cyprinus carpio*, (6).

White bass made up 61.2 % of the total weight (377 kg) of all fishes harvested. Suckers ranked second by weight (170 kg), followed by white crappie (43 kg), black basses (9 kg), leptomids (9 kg), carp (7 kg), and rock bass (2 kg) in that order. Although carp was represented in the headwaters survey, this species was scarce in population studies on the reservoir and was never recorded in creel surveys on the reservoir.

Summary and Conclusions

The impounding of Rough River had a pronounced effect on the sport fishing effort and total harvest. In 1959, fishermen expended only 28 man-hours per

day (for 214 days of fishing) on this remote and inaccessible stream. Upon impoundment of the river in 1961, several convenient access points and other facilities were developed, and attracted a large number of fishermen. Estimated fishing effort on Rough River Reservoir averaged 1,058 man-hours per day during the first 4 years of impoundment (765 days of fishing). Accordingly, the sport-fish harvest increased from 3,195 fish (410 kg) in 1959 to 168,622 fish (13,437 kg) during the first 4 months of impoundment in 1961. During the next 3 years, an annual average of 216,944 fish (28,518 kg) was harvested by sport fishermen. Fishing effort and total harvest during the initial years of impoundment far exceeded that for other young flood-control reservoirs in Kentucky.

The transition from stream to reservoir obviously was beneficial to some sport fishes and detrimental to others. Native fishes that flourished in the reservoir were white crappie, largemouth bass, and bluegill. Lepomids (chiefly bluegill) were the most plentiful fishes in the creel, and completely dominated the catch numerically both before and after impoundment. Black basses made up a substantial percentage of the total weight harvested each year and surpassed all other groups during the second and third years of impoundment. The catch of crappies increased annually, and by the fourth year of impoundment had supplanted black basses in terms of weight harvested. Alteration of the stream habitat adversely affected small-mouth bass and rock bass, but the decimation of these species was tempered considerably by stocking sport fishes, such as largemouth bass and white bass, which were adaptable to the lentic environment.

In addition to bolstering the sport fishery in the reservoir, the white bass also made substantial contributions to sport fishing in the headwaters during their spawning migrations. In the spring of 1963, more than 1,300 white bass were harvested from the headwaters of

the reservoir during a 6-day fishing period. More spectacular white bass runs have occurred in other years, but were not evaluated by creel surveys.

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Literature Cited

- Carter, James P. 1968. Pre- and post-impoundment surveys on Nolin River. Ky. Dep. Fish Wildl. Resour., Fish. Bull. No. 48, 28 p.
- 1969. Pre- and post-impoundment surveys on Barren River. Ky. Dep. Fish Wildl. Resour., Fish. Bull. No. 50, 33 p.
- Lambou, Victor W. 1961. Determination of fishing pressure from fishermen or party counts with a discussion of sampling problems. Proc. Southeast. Ass. Game Fish Comm. 15th Annu. Conf.:380-401.
- Turner, William R. 1967. A pre- and post-impoundment survey of Middle Fork of the Kentucky River. Ky. Dep. Fish Wildl. Resour., Fish. Bull. No. 51, 72 p. + 11 figs.